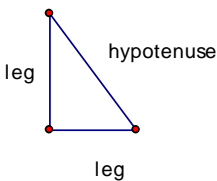


## Distance and Midpoint Formulas and Other Applications

### The Pythagorean Theorem (pg. 476):

In any right triangle, if  $a$  and  $b$  are the lengths of the legs and  $c$  is the length of the hypotenuse, then

$$a^2 + b^2 = c^2$$

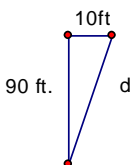


### The principle of Square Roots (pg. 477):

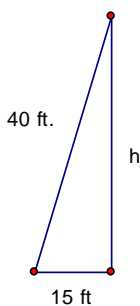
For any nonnegative real number  $n$ , If  $x^2 = n$ , then  $x = \sqrt{n}$  or  $x = -\sqrt{n}$  or  $x = \pm\sqrt{n}$

### Examples:

A baseball diamond is actually a square 90 feet on a side. Suppose a catcher fields a ball while standing on the third-base line 10 feet from home plate. How far is the catcher's throw to first base? Give an exact answer and an approximation to three decimal places.

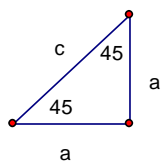


The base of a 40-ft long guy wire is located 15 ft from the telephone pole that it is anchoring. How high up the pole does the guy wire reach? Give an exact answer and an approximation to three decimal places.



### Two Special Triangles (pg. 478 – 479)

**Isosceles right triangle:** When both legs of a right triangle are the same size, we call the triangle an isosceles triangle. If one leg of an isosceles right triangles has length  $a$ , then the other leg also has a length of  $a$ . Also the length of the hypotenuse would be  $a\sqrt{2}$



**Examples:**

1. One leg of an isosceles right triangle measures 7 cm. Find the length of the hypotenuse.

2. The hypotenuse of an isosceles right triangle is 5 ft long. Find the length of a leg.

**The second special right triangle: 30-60-90 triangle (pg. 480)**

Draw an equilateral triangle. Construct an altitude. The altitude divides the equilateral triangle into two congruent triangles, each with a 30-60-90 degrees. If the length of the side opposite the 30 degree angle is called "x", the length of the side opposite the 60 degree angle is  $x\sqrt{3}$  and the hypotenuse has length 2x.

**Example:**

The shorter leg of a 30-60-90 triangle measures 8 inches. Find the length of the other sides. Give exact answers and where appropriate an approximation to three decimal places.

The length of the longer leg of a 30-60-90 triangle is 14 cm. Find the length of the hypotenuse. Give exact answer and an approximation to three decimal places.

**The Distance and Midpoint formulas (pg. 481)**

The distance formula "d" between any two points  $(x_1, y_1)$  and  $(x_2, y_2)$  is given by

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

**Example:** Find the distance between (5,-1) and (-4, 6). Find the exact answer and an approximation to three decimal places.

**Midpoint Formula (pg. 481):** If the endpoints of a segment are  $(x_1, y_1)$  and  $(x_2, y_2)$ , then the

coordinates of the midpoint are  $\left( \frac{(x_1 + x_2)}{2}, \frac{(y_1 + y_2)}{2} \right)$

**Example:**

Find the midpoint of the segment with endpoints  $(-2,3)$  and  $(4,-6)$